

WHAT IS CLAIMED IS:

1. A system, comprising:
a processor; and
5 a memory comprising program instructions, wherein the program instructions are executable by the processor to implement file system software comprising a multi-class storage mechanism, wherein the multi-class storage mechanism is configured to:
monitor access of data stored in a multi-class file system comprising a
10 hierarchy of storage classes to generate access information for the data, wherein each storage class comprises one or more storage devices assigned to the storage class according to one or more characteristics of the storage class;
apply the access information to a set of policies for the multi-class file
15 system; and
migrate a portion of the data to different storage classes in the hierarchy of storage classes in response to said application of the access information to the set of policies for the multi-class file system;
wherein the migrated data remains online within the multi-class file system.
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2. The system as recited in claim 1, wherein the file system software further comprises File System functionality configured to implement the hierarchy of storage classes of the multi-class file system.
- 25 3. The system as recited in claim 1, wherein the storage classes are ordered in the hierarchy of storage classes according to performance characteristics from a highest storage class comprising one or more high-performance storage devices to a lowest storage class comprising one or more low-performance storage devices.
- 30 4. The system as recited in claim 1, wherein the multi-class storage mechanism is

further configured to migrate less-frequently-accessed data to lower storage classes comprising lower-performing storage devices and to migrate more-frequently-accessed data to higher storage classes comprising higher-performing storage devices according to the set of policies.

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5. The system as recited in claim 1, wherein the multi-class storage mechanism is further configured to compress data migrated to one or more storage classes in the hierarchy of storage classes.

10 6. The system as recited in claim 1, wherein the multi-class storage mechanism is further configured to initially place the data in the storage classes in the hierarchy of storage classes according to the set of policies.

7. The system as recited in claim 1, wherein the multi-class storage mechanism is
15 further configured to modify file system metadata for the migrated data to indicate the different storage classes for the migrated data, wherein path information in the file system metadata exposed to applications is not modified.

8. The system as recited in claim 1, wherein said migration of a portion of the data to
20 the different storage classes is transparent to an application configured to access the multi-class file system.

9. The system as recited in claim 1, wherein the migrated data includes files or
portions of files.

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10. The system as recited in claim 1, wherein the migrated data comprises one or more of application data and file system metadata.

11. The system as recited in claim 1, wherein the file system software is configured to
30 add a new storage class to the hierarchy of storage classes, and wherein the multi-class

storage mechanism is further configured to migrate data stored on one or more others of the storage classes to the new storage class according to the set of policies.

12. The system as recited in claim 1, wherein the file system software is configured to
5 add a new storage device to a storage class in the hierarchy of storage classes, and
wherein the multi-class storage mechanism is further configured to migrate data stored on
one or more of the storage classes to the new storage device according to the set of
policies.

10 13. The system as recited in claim 1, wherein the file system software is configured to
increase the capacity allocated to a storage class on a storage device within the storage
class.

14. A system, comprising:
15 a plurality of storage devices;
a host system configured to couple to the plurality of storage devices via a
network, wherein the host system comprises file system software
comprising:
File System functionality configured to implement a multi-class file
20 system comprising a hierarchy of storage classes on the plurality of
storage devices, wherein each storage class comprises one or more
of the storage devices assigned to the storage class according to
one or more characteristics of the storage class; and
a multi-class storage mechanism configured to:
25 monitor access of data stored in the multi-class file system to
generate access information for the data;
apply the access information to a set of policies for the multi-class
file system; and
migrate a portion of the data to different storage classes in the
30 hierarchy of storage classes in response to said application

of the access information to a set of policies for the multi-class file system;

wherein the migrated data remains online within the multi-class file system.

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15. A system, comprising:

means for implementing a multi-class file system comprising a hierarchy of storage classes on a plurality of storage devices, wherein each storage class comprises one or more of the storage devices assigned to the storage class according to one or more characteristics of the storage class;

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software means for assigning and migrating data to different storage classes in the hierarchy of storage classes according to a set of policies for the multi-class file system.

15 16. A method, comprising:

multi-class storage mechanism software monitoring access of data stored in a multi-class file system comprising a hierarchy of storage classes to generate access information for the data, wherein each storage class comprises one or more storage devices assigned to the storage class according to one or more characteristics of the storage class;

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the multi-class storage mechanism software applying the access information to a set of policies for the multi-class file system; and

migrating a portion of the data to different storage classes in the hierarchy of storage classes in response to said applying the access information to the set of policies for the multi-class file system;

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wherein the migrated data remains online within the multi-class file system.

17. The method as recited in claim 16, wherein the multi-class storage mechanism software is part of file system software.

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18. The method as recited in claim 16, further comprising File System functionality of file system software implementing the hierarchy of storage classes of the multi-class file system.

5 19. The method as recited in claim 16, wherein the storage classes are ordered in the hierarchy of storage classes according to performance characteristics from a highest storage class comprising one or more high-performance storage devices to a lowest storage class comprising one or more low-performance storage devices.

10 20. The method as recited in claim 16, wherein said migrating comprises:
migrating less-frequently-accessed data to lower storage classes comprising
lower-performing storage devices; and
migrating more-frequently-accessed data to higher storage classes comprising
higher-performing storage devices.

15 21. The method as recited in claim 16, further comprising compressing data migrated to one or more storage classes in the hierarchy of storage classes.

22. The method as recited in claim 16, further comprising the multi-class storage
20 mechanism software initially placing the data in the hierarchy of storage classes according to the set of policies.

23. The method as recited in claim 16, further comprising the multi-class storage
mechanism software modifying file system metadata to indicate the different storage
25 classes for the migrated data, wherein path information in the file system metadata exposed to applications is not modified.

24. The method as recited in claim 16, wherein said migrating a portion of the data to
different storage classes is transparent to an application that accesses the data in the
30 hierarchy of storage classes.

25. The method as recited in claim 16, wherein the migrated data includes files or portions of files.

5 26. The method as recited in claim 16, wherein the migrated data comprises one or more of application data and file system metadata.

27. The method as recited in claim 16, further comprising:
adding a new storage class to the hierarchy of storage classes; and
10 the multi-class storage mechanism software transparently migrating data from one or more others of the storage classes to the new storage class.

28. The method as recited in claim 16, further comprising:
adding a new storage device to a storage class in the hierarchy of storage classes;
15 and
the multi-class storage mechanism transparently migrating data stored on one or more of the storage classes to the new storage device.

29. The method as recited in claim 16, further comprising increasing the capacity
20 allocated to a storage class on a storage device within the storage class.

30. A computer-accessible medium comprising program instructions, wherein the program instructions are configured to implement:
monitoring access of data stored in a multi-class file system comprising a
25 hierarchy of storage classes to generate access information for the data,
wherein each storage class comprises one or more storage devices assigned to the storage class according to one or more characteristics of the storage class;
applying the access information to a set of policies for the multi-class file system;
30 and

migrating a portion of the data to different storage classes in the hierarchy of storage classes in response to said applying the access information and other file information to the set of policies for the multi-class file system; wherein the migrated data remains online within the multi-class file system.

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31. The computer-accessible medium as recited in claim 30, wherein the storage classes are ordered in the hierarchy of storage classes according to performance characteristics from a highest storage class comprising one or more high-performance storage devices to a lowest storage class comprising one or more low-performance storage devices.

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32. The computer-accessible medium as recited in claim 30, wherein, in said migrating, the program instructions are further configured to implement:

migrating less-frequently-accessed data to lower storage classes comprising lower-performing storage devices; and migrating more-frequently-accessed data to higher storage classes comprising higher-performing storage devices.

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33. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement compressing data migrated to one or more storage classes in the hierarchy of storage classes.

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34. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement initially placing the data in the hierarchy of storage classes according to the set of policies.

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35. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement modifying file system metadata to indicate the different storage classes for the migrated data, wherein path information in the file system metadata exposed to applications is not modified.

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36. The computer-accessible medium as recited in claim 30, wherein said migrating a portion of the data to different storage classes is transparent to an application that accesses the data in the hierarchy of storage classes.

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37. The computer-accessible medium as recited in claim 30, wherein the migrated data includes files or portions of files.

38. The method as recited in claim 30, wherein the migrated data comprises one or
10 more of application data and file system metadata.

39. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement:

adding a new storage class to the hierarchy of storage classes; and
15 transparently migrating data from one or more others of the storage classes to the new storage class.

40. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement:

20 adding a new storage device to a storage class in the hierarchy of storage classes;
and
the multi-class storage mechanism transparently migrating data stored on one or more of the storage classes to the new storage device.

25 41. The computer-accessible medium as recited in claim 30, wherein the program instructions are further configured to implement increasing the capacity allocated to a storage class on a storage device within the storage class.